ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Current Research in Dental Sciences

Review *Derleme*

DOI: 10.5152/CRDS.2023.4976

Pediatric Dentistry During and After COVID-19

Covid-19 Süresince ve Sonrasında Çocuk Diş Hekimliği

Büşra KARADURAN
Mine KORUYUCU

İstanbul University, Faculty of Dentistry, Department of Pedodontics, İstanbul, Turkey

ABSTRACT

COVID-19 emerged in China in the last month of 2019 and caused a global pandemic. It was stated that it is more rapidly spreading and contagious than SARS-COV and MERS-COV. Aerosol and droplet spreading are the most common modes of transmission of COVID-19 and are a concern in most dental procedures. For this reason, the popularity of minimally invasive dental procedures is increasing due to the advantage of minimal aerosol formation and reducing the risk of COVID-19 cross-infection. Pediatric dentists may also prefer these procedures more frequently because of their high acceptability by children. This review article aims to explain the changes that may occur in dentistry and pediatric dentistry procedures as a result of the COVID-19 pandemic.

Keywords: COVID-19, aerosol, pediatric dentistry, minimally invasive dentistry

ÖZ

COVID-19, 2019 yılının son döneminde Çin'de ortaya çıkmıştır ve tüm dünyaya yayılarak pandemiye neden olmuştur. SARS-CoV ve MERS-CoV'a göre daha hızlı yayıldığı ve bulaştırıcılığının daha fazla olduğu belirtilmektedir. COVID-19'un en önemli bulaş yolu aerosol ve damlacık yayılımı ile olmaktadır. Hemen hemen çoğu diş hekimliği prosedürü de aerosol ve damlacık oluşmasına ve yayılmasına neden olabilmektedir. Bu nedenle hem diş hekimlerini hem de hastaları koruyabilmek ve çapraz enfeksiyon riskini azaltabilmek için aerosol oluşumunun hiç veya minimal olması avantajı nedeniyle minimal invaziv diş hekimliği uygulamalarının popülerliği COVID-19 pandemisiyle birlikte giderek artmaktadır. Çocuklar tarafından kabul edilebilirliğinin yüksek olması da çocuk diş hekimlerinin bu prosedürleri daha sık tercih etmesini sağlayabilmektedir. Bu derlemenin amacı COVID-19 pandemisiyle birlikte diş hekimliği ve çocuk diş hekimliği prosedürlerinde oluşabilecek değişiklikleri anlatmaktır.

Anahtar Kelimeler: Covid-19, aerosol, çocuk diş hekimliği, minimal invaziv diş hekimliği

INTRODUCTION

COVID-19 emerged in China in the last month of 2019 and caused a global pandemic. It is also called SARS-COV-2 because of its close phylogenetic resemblance to the SARS-COV, which caused a worldwide pandemic.[1] The virus is transmitted directly from an infected individual to healthy individuals through aerosols and droplets caused by close contact, speech, sneezing, and coughing.[2] Indirect transmission can also occur through the mucous membranes by touching the mouth, nose, or eyes because of surface contact with the droplets emitted by another infected person.[3] There are uncertainties and different studies regarding how long the virus remains infective in the external environment.[4]

In studies examining the genetic structure of COVID-19, variations and mutations have been observed over time. RNA viruses such as COVID-19 have high mutation rates and are likely to undergo mutations in order to evade host defense mechanisms.[5] The resulting mutations also raise questions about whether vaccines developed against the COVID-19 virus should be updated periodically.[6] According to the World Health Organization (WHO), mutating COVID-19 variants that have occurred are currently not resistant to vaccines, but it is possible that they develop a resistant phenotype earlier than expected. This possibility demonstrates that emerging new variants of COVID-19 should be followed closely.[7]

Geliş Tarihi/Received: 26.04.2021
Kabul Tarihi/Accepted: 21.01.2022
Yayın Tarihi/Publication Date: 31.07.2023

Sorumlu Yazar/Corresponding Author: Büşra KARADURAN
E-mail: bsrkaraduran@gmail.com

Cite this article as: Karaduran B, Koruyucu M. Pediatric dentistry during and after COVID-19. *Curr Res Dent Sci.* 2023;33(3):179-184.

COVID-19 in Children

The general source of transmission in children infected with COVID-19 is family contact. General COVID-19 symptoms in children include fever, dry cough, difficulty breathing, nasal congestion, and sore throat. Gastrointestinal symptoms such as vomiting, abdominal pain, and diarrhea occur more frequently in children than in adults.[8] It is stated that the clinical symptoms of COVID-19 in children are similar to those of influenza, and in most pediatric cases, recovery is observed within 1-2 weeks.[9] Hospitalization and death rates as a result of infection are reported to be lower in children compared to adults.[10,11] Children of all age groups can be infected with COVID-19, and there is no gender discrimination.[12] Since cases in children are generally asymptomatic, fewer cases may have been detected compared to adults. The WHO states that asymptomatic people have a lower risk of transmitting the virus compared to symptomatic patients, but asymptomatic patients may still increase the spread of the virus.[13] Recent studies also show that children are less affected by the spread of the virus than adults.[14]

Surprisingly, the number of pediatric COVID-19 cases is less compared with adults. The reason may depend on both the exposure rate and the host. Children are generally well taken care of at home. For this reason, exposure rates to viruses and pathogens are relatively lower than in adults. The fact that the maturity, level of development, and function of the COVID-19 cell receptor angiotensin-converting enzyme-2 (ACE-2) are lower in children than in adults can explain the less severe course of the disease. Children often have respiratory tract infections during the winter months, so they have greater resistance to viruses and higher levels of antibodies. Furthermore, a child's immune system is still in the development process and may respond to pathogens differently than the adult immune system.[12,15,16] In childhood, the innate immune system is more active and the rate of concomitant chronic diseases is lower.[17] In adults, the inflammatory response and cytokine storm are more intense than in children, so lung damage and a more severe course of the disease are more frequently observed in adults than in children.[18] Age-related decrease in the production of the hormone melatonin may also explain the milder infection in children compared to adults, as melatonin reduces oxidative lung injury and inflammatory cell migration during viral infections.[19]

Kawasaki syndrome, which affects many systems in which angular cheilitis and strawberry tongue are common,[20] is a seasonal and rare severe inflammatory disease that occurs mostly in children under the age of 5. The cause is unclear, but as yet, unidentified infectious pathogens may be the major cause. One serious complication of Kawasaki syndrome is coronary artery aneurysm, which can lead to arterial rupture, thrombosis formation, and myocardial infarction.[21] It has been observed that inflammatory syndrome-like clinical features similar to Kawasaki syndrome, which can affect over one system, occur in some children hospitalized with COVID-19 infection.[22] Many of the hypotheses regarding the cause are that some children may be genetically predisposed to have a stronger inflammatory response to certain viruses. It has been shown that viral factors and even COVID-19 may be effective in the emergence of Kawasaki syndrome.[23] Because of the increase in the accumulation of inflammatory cells due to the increase in ACE-2 in endothelial cells with COVID-19 infection, endothelial cell damage and dysfunction may occur, and therefore, COVID-19 may be a trigger for clinical features like those of Kawasaki syndrome.[21] Centers for Disease Control and Prevention (CDC) defined the clinical features, which can affect more than one system in children, including the heart, lungs, kidneys, brain, skin, eyes, or gastrointestinal organs, as COVID-19-associated multisystem inflammatory syndrome (MIS-C). It can cause a variety of symptoms in children, including fever, stomachache, vomiting, diarrhea, sore throat, rash, bloodshot eyes, or extreme fatigue. It is not yet known what causes this clinical picture, but the medical histories of these children do reveal that they have had the virus that causes COVID-19 or been in contact with someone with COVID-19.[24] The presence of oral or pharyngeal findings such as red and edematous lips and strawberry tongue may be early signs of MIS-C in children. Pediatric dentists can play an important role in both the early detection of MIS-C through its oral manifestations and the identification of oral lesions in children with confirmed MIS-C.[25]

Dentistry and COVID-19

Epidemiological studies have shown that COVID-19 is more contagious than SARS-COV and MERS-COV.[26] Therefore, clinics and consulting rooms cannot continue to operate as they did in the period before the epidemic, and dentists must take extra precautions. The following are some of the precautions that are being taken: evaluating and offering guidance to patients through telephone calls before they come to clinics, creating large and well-ventilated patient reception areas, establishing triage areas in clinics where patients are pre-checked and evaluated, using extra-oral high volume suction systems, negative pressure rooms, strict sterilization protocols, N95 masks, and other extra personal protective equipment, ensuring accurate and necessary appointment planning,[27] and also using rubber-dam isolation and the four-hand technique by working with an assistant. Some of the dental needs of patients can be satisfied through telephone conversations, photography, video conferences, and emails. These applications can also be employed as preventive treatment procedures.[28] Indeed, teledentistry is aimed at facilitating dental care and providing guidance, education, and treatment to patients without face-to-face meetings. Teledentistry also has various sub-groups such as teleconsultation, telediagnosis, telemonitoring, and teletriage.[29]

The use of mouthwashes before dental treatments can reduce the number of microorganisms in the patients' oral cavities. However, it has been reported that chlorhexidine mouthwashes are not effective because COVID-19 is very sensitive to oxidation.[30] Yet, a study conducted by Yoon et al[31] found that gargling with 15 mL of 0.12% chlorhexidine mouthwash suppressed COVID-19 for 2 hours. Another recent study showed that chlorhexidine along with flavonoid group agents had an inhibitory effect on some of the main protease regions that play a critical role in the life cycle of the virus that causes COVID-19.[32] The use of mouthwashes with oxidative properties such as 1% hydrogen peroxide or 0.2% povidone-iodine is recommended.[33] However, iodine allergies must be taken into consideration, and povidone-iodine should not be used in patients with iodine allergies[34] because it has higher virucidal activity than antiseptics such as chlorhexidine and benzalkonium chloride.[31] The use of 9 mL of 1% or 1.5% hydrogen peroxide mouthwash for 30 seconds before procedures has also been reported to be effective.[35] In addition, cetylpyridinium chloride, which is a quaternary ammonium compound, has been found to be effective against enveloped viruses such as coronavirus because it can disintegrate the viral capsule with its lysosomotropic mechanism.[31] In pediatric patients and disabled individuals who are not capable of using mouthwash, an

antiseptic mouthwash should be applied by wiping the inside of the mouth with the help of gauze.[28]

The use of air–water sprays should be avoided as much as possible because they may produce aerosols during the inspection.[36] Dental procedures that generate aerosols should not last longer than 45 minutes, and appointments should be set for 1 hour.[28] Clinics must also be ventilated for at least 15 minutes after each patient, and to increase aerosol dissipation, it is recommended that patients do not spit. Since the risk of exposure to the virus increases when the air conditioners available in clinics work with indoor air systems, central air conditioning systems that work with outside air and expel the air into the environment are preferred.[37] High volume evacuators (HVE) and high-efficiency particulate arresting (HEPA) filters can be used to clean the ambient air as well.[38] The use of ultraviolet light with wavelengths of 250-280 nanometers is also recommended for disinfecting the environment and surfaces.[39] Ozone gas, which consists of 3 oxygen atoms (O_3), is a strong oxidizing agent and antiseptic, and this gas can be used to treat contaminated surfaces, water, and ambient air. It has been reported that the application of ozone for 8-10 minutes is sufficient to destroy 99.9% of the viral particles that are suspended in the air.[40]

It has also been shown that when cavity preparations that cause aerosol formation with rotary instruments are performed using rubber dams, the aerosol spread is 70%-90% less.[33] To reduce aerosol formation during canal shaping, it is recommended that hand instruments be used instead of rotary instruments, and rubber-dam isolation is also necessary for crowns, bridges, and other prosthetic preparations. Changes such as the use of supra-gingival margins can be considered for rubber dams in treatment planning as well.[30] However, the split-dam technique may be preferred when gingival areas are involved, such as for Class V restorations, crowns, and bridge preparations.[41] It is also recommended that single-stage self-etching systems be used rather than total-etch systems as adhesive systems in patients for whom composite resin-containing filling materials will be applied because total-etch systems require multi-stage washing and drying processes. If problems arise in existing restorations, the option of repair should be considered as a priority over renovation.[42]

The aerosol formation can also be prevented by using techniques such as chemomechanical and atraumatic restorative treatments (ART) rather than rotary instruments in the caries removal process.[38] The removal of caries through chemomechanical techniques is a non-invasive method in which infected dentin is softened with a suitable chemical agent and removed with the help of hand instruments. This process not only ensures the removal of infected dentin but also preserves the healthy tooth structure and does not cause pulpal irritation. Because it does not require the application of local anesthesia or the use of burs, this process facilitates the removal of caries tissue in anxious and non-cooperative patients.[43] Studies that have compared the use of this method in primary, and permanent teeth have found that because the cavities are generally open in primary teeth, a reduced volume of solution is required, access to the cavities is easier, and caries can be removed more effectively.[44]

Care should be taken to avoid the nausea reflex during the measurement process, so the saliva ejector should be used carefully, and the size of the measuring spoon should be chosen appropriately. The gag reflex can be suppressed by applying a topical anesthetic to the oral mucosa.[38] Impression materials have also been cited as a source for infection transmission between clinical and dental laboratories.[45] In addition, intraoral methods of taking digital impressions are preferred over other methods because of the advantages they offer such as reducing stress and fear among patients, not causing the nausea reflex, not requiring plaster models, saving time and space, and providing laboratory safety.[46]

Extraoral radiographs are preferred over intraoral radiographs to avoid the risk of aerosol formation that may cause cough and vomiting reflexes,[47] but panoramic and cone-beam computed tomography (CBCT) require the patient to stand or sit still during the irradiation period, while intraoral radiographs can be used in patients in the supine position with a mobile x-ray device. The diagnostic quality of intraoral radiographs is higher than panoramic radiographs, and CBCT is not an alternative to intraoral radiographs due to its lower resolution, the visualization of artifacts from motion and metallic restorations, and much higher radiation dose.[48]

In patients undergoing orthodontic treatment, if there is a wound on the mucosa due to the bracket, the use of candles and mouthwashes is recommended. Applying topical anesthetic gels can reduce pain. In the presence of a broken or displaced fixed lingual arch, palatal arch, or expansion appliance, if the appliance is partially displaced, it is recommended to try to replace it; screw activations should be stopped until consultation with the orthodontist. If an appliance has completely exited, the patient should store it in a safe place until seeing the orthodontist.[49] The presence of an orthodontic appliance embedded in the gingiva causing severe pain and infection is an emergency; the patient should immediately consult the orthodontist.[50]

Performing dental treatments under sedation can be risky during a COVID-19 outbreak. For example, in inhalation sedation using nitrous oxide and oxygen gases, aerosols are produced by the flow of gases in a semi-closed circulation, and aerosols can easily spread when the nasal mask is not completely sealed.[51] For the application of inhalation sedation, the nose cap should be chosen in such a way that there is no space for the patient, and all sterilization rules should be strictly followed. An extraoral vacuum device can reduce the risk of aerosol spread.[52] The use of disposable nose caps and tubing is also recommended to reduce the risk of viral transmission.[53] Symptoms such as coughing, sneezing, and difficulty breathing seen in COVID-19 may limit the choice of inhalation sedation. For this reason, other sedation methods such as intravenous and oral sedation may be preferred. In order to prevent possible virus spread through aerosols, general anesthesia can be chosen in the treatment of patients who cannot be treated with routine dentistry practices and who have sedation contraindications to reduce the risk of aerosols.[51] It is recommended to perform a PCR test for COVID-19 at least 48 hours before the planned procedures under general anesthesia and that the test be repeated after at least 24 hours in patients with negative results but suspicious findings. Surgery should be performed within 7 days of a negative test result.[54]

Pediatric Dentistry and COVID-19

The fundamental challenge for dentists is to provide appropriate infection control for children and adolescents depending on their different levels of physical, intellectual, emotional, and social

development, with special regard to their psychological states. It is stated that toys used in the clinic for pediatric patients can be a potential source of cross-infection. Soft toys are more likely to be contaminated than toys with hard surfaces, are more difficult to disinfect, and can be recontaminated more quickly. In addition, instruments that are used to control and restrict the movements of pediatric patients, such as Velcro, can be contaminated and therefore need to be disinfected.[55] Special sessions and more time should be allocated for the dental procedures of uncooperative patients, which may require behavioral management techniques and physical contact.[28] Because restless, crying, and uncooperative children cause more aerosol emissions than calm and cooperative children,[56] it is recommended that the dental treatments of immunocompromised children be scheduled as the first appointment of the day to minimize the risk of exposure to possible sources of infection.[57]

The important thing is to help children improve their oral hygiene, reduce their risk of caries formation, and ensure that they do not need dental interventions that require a visit to the clinic. Protection against caries depends on the provision of adequate and effective oral hygiene and a correct diet that limits carbohydrate intake. With the increase in time spent at home, the frequency of consumption of cariogenic foods may increase. This situation increases the risk of developing early childhood caries (ECC), especially in children aged 3-5 years.[58] It is stated that there is a relationship between a family's socioeconomic status and the risk of their children developing caries. At the same time, it has been observed that the oral hygiene of parents influences the oral health of their children.[59] It is reported that the risk of domestic trauma in children increases as their time spent at home increases. It is recommended that children with high trauma risk be protected with mouthguards to avoid risky situations that may require urgent intervention.[60]

It is recommended to avoid aerosol-generating procedures and to use minimally invasive procedures as much as possible due to the COVID-19 outbreak.[61] Minimally invasive dentistry (MID) procedures constitute an approach that includes a range of techniques to treat carious lesions, from non-removal to selective removal of carious tissue. Many MID techniques include procedures that are safe, acceptable to children, and effective in reducing aerosol formation. These procedures ensure that tooth structure is preserved and that the risk of pulp perforation is reduced. Reducing the need for local anesthesia reduces the child's tension and fear, thus lessening the diffusion of aerosols. In addition, since most MID procedures can be completed in a short period of time, they shorten the waiting time for other patients and reduce the number of patients in the waiting room. These techniques include the application of fissure sealant, the resin infiltration technique, the Silver Diamine Fluoride (SDF) application, the Hall technique, the ART technique, and the selective removal of carious tissue.[62]

In the treatment of caries lesions without cavitation, the fluoride varnish application, resin infiltration application, or healing with fissure sealant can be preferred. Depending on the circumstances of caries lesions with cavitation, the SDF application, the Hall technique, the ART technique, interim therapeutic restorations, or indirect pulp capping can be applied.[63] While all sound and soft caries tissue is removed in traditional (total) caries removal methods, different procedures have been developed to reduce the possibility of pulp perforation and to protect the tooth.[64] In studies examining stainless steel crowns applied without removing caries tissue in primary teeth or healing fissures with sealant, it was reported that caries changed from an active form to an inactive form and that there was a decrease in the number of bacteria. In one-step selective removal of caries, partially soft infected caries are removed and a permanent restoration is performed. In this treatment, it is reported that the number of microorganisms in the lesion, which is disconnected from the oral environment, decreases and that the progression of caries is stopped. In the first session of the two-step caries removal method, the periphery caries tissue is removed, the infected caries tissue on the pulp is left untouched, and the tooth is temporarily restored by applying a capping material on it. In the second session 3-6 months later, it was reported that the caries had passed into the inactive form and a permanent restoration was applied.[65]

The Hall technique is a method in which dental caries is treated with a stainless steel crown without any tooth preparation or local anesthesia applications. It aims to change the bacterial content of caries by disconnecting its relationship with the oral environment and stopping its progression. Although it has a high success rate in primary teeth, it can only be applied temporarily until permanent restorations are made in permanent teeth with high substance loss.[66]

In the ART technique, dental caries tissue is removed with the help of hand instruments. The prepared cavity is restored with glass ionomer filling material, which can release fluoride and prevent secondary caries formation. Local anesthesia is rarely required. This technique is preferred mostly in underdeveloped countries because of its low cost. Since its application steps do not cause fear in children, its acceptability is high.[67]

Interim therapeutic restorations is the preferred approach when there are barriers to ideal conventional dental treatment. These barriers may be related to the patient's oral hygiene, difficulties in preparation, and restoration of the cavity. Interim therapeutic restorations can be applied to both primary and permanent teeth in uncooperative children, patients with disabilities, and patients who require special health care. In this caries removal process, hand or rotary instruments can be partially used. As in the ART technique, the restoration process is carried out with glass ionomer filling material. The restoration should be replaced with permanent filling material after 6 months.[68]

Silver diamine fluoride is a colorless solution that stops the progression of dental caries. It is applied topically to tooth surfaces. It offers the advantages of not requiring local anesthesia, being cost-effective, simple to apply, not requiring the use of expensive equipment, and being noninvasive. However, the fact that it stains teeth black and has a metallic taste can disturb the patients. Potassium iodide (KI) application is recommended to address the discoloration problem.[69] It is thought that after the SDF application destroys bacteria and stops the progression of the caries lesion, the lesion should be restored in order to disconnect it from the oral environment and restore the old form of the tooth. As in the ART technique, a glass ionomer filling material that is chemically bonded to the tooth is preferred. This approach aims to protect the vitality of pulp by severing the relationship between caries and the oral environment.[70]

Resin infiltration application is used in the treatment of initial enamel lesions. The aim is to increase the porosity of the hypermineralized layer on the surface of initial enamel lesions with strong acid and to allow the low-viscosity resin to penetrate

the lower layers of the lesion. Opaque white spot lesions caused by mineral loss and enamel demineralization in initial enamel lesions need to be treated so that caries does not progress and may disturb the patient aesthetically.[71]

CONCLUSION

Studies related to transmission routes, symptoms, diagnosis, treatment, and vaccines related to COVID-19 are ongoing. Dentists are among the occupational groups most frequently affected by the virus, which has made disinfection and sterilization rules even more important. In addition, the thought that the epidemic will become endemic makes it necessary to get used to COVID-19 and a new normal in the coming years.

During COVID-19 outbreaks, dentists can recommend the use of chlorhexidine and propolis-containing dental products that are in the flavonoid group, because the COVID-19 virus has features such as viral inactivation on the main protease regions. Besides advantages such as little or no aerosol formation and reducing the risk of cross-infection, its high acceptability among children may enable pediatric dentists to prefer MID procedures for their ease of application.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – B.K., M.K.; Design – B.K., M.K.; Supervision – B.K., M.K.; Resources – B.K., M.K.; Materials – B.K., M.K.; Data Collection and/or Processing – B.K., M.K.; Analysis and/or Interpretation – B.K., M.K.; Literature Search – B.K., M.K.; Writing Manuscript – B.K., M.K.; Critical Review – B.K., M.K.

Declaration of Interests: The authors declare that they have no competing interest.

Funding: The authors declared that this study has received no financial support.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Fikir– B.K., M.K.; Tasarım – B.K., M.K.; Denetleme – B.K., M.K.; Kaynaklar – B.K., M.K.; Malzemeler – B.K., M.K.; Veri Toplanması ve/veya İşlemesi – B.K., M.K.; Analiz ve/veya Yorum – B.K., M.K.; Literatür Taraması – B.K., M.K.; Yazıyı Yazan – B.K., M.K.; Eleştirel İnceleme – B.K., M.K.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

REFERENCES

1. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, evaluation, and treatment of coronavirus (COVID-19). In: *StatPearls*. Treasure Island (FL): StatPearls Publishing. 2021.
2. World Health Organization. *Laboratory testing for coronavirus disease 2019 (COVID-19) in suspected human cases: interim guidance* [internet]. 2020. WHO; Geneva. Available at: https://apps.who.int/iris/handle/10665/331329
3. McIntosh K. *Coronavirus disease 2019 (COVID-19): epidemiology, virology, clinical features, diagnosis, and prevention* [internet]. UpToDate. Available at: https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-epidemiology-virology-clinical-features-diagnosis-and-prevention. Accessed 10 April 2020.
4. Metintas S. COVID-19'un Epidemiyolojisi. *EurAsion J pulmonol*. Göğüs Hastalıkları Uzmanlarının Bilmesi Gerekenler Başlıklı Ek Sayısı. 2020:4-15.
5. Noman AA, Ekra JE, Meem RI, Islam MS, Sharzana F. Islam MS et al. The COVID-19 pandemic: a comprehensive review of the genomic variations, epidemiological features, diagnosis, treatment and intervention schemes in South Asia. *Authorea Prepr*. 2021;1-19. [CrossRef]
6. Kupferschmidt K. Fast-spreading U.K. virus variant raises alarms. *Science*. 2021;371(6524):9-10. [CrossRef]
7. Kupferschmidt K. New mutations raise specter of 'immune escape'. *Science*. 2021;371(6527):329-330. [CrossRef]
8. Credie GB, Coelho AA, Rezende KM. Coronavirus (COVID-19) in children: history and pediatric Oral Health. *Dent Oral Biol Craniofac Res*. 2020;3(3):2-4.
9. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr*. 2020;109(6):1088-1095. [CrossRef]
10. Yavas SP, Arga G. COVID-19 and children; what have we learned so far? *ESTUDAM public health journal*. 2020;5:96-107.
11. Tagarro A, Epalza C, Santos M, et al. Screening and Severity of Coronavirus Disease 2019 (COVID-19) in Children in Madrid, Spain. *JAMA Pediatr* 2020:e201346. [CrossRef]
12. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 among children in China. *Pediatrics*. 2020;145(6):e20200702. [CrossRef]
13. Li C, Ji F, Wang L, et al. Asymptomatic and human-to-human transmission of SARS-CoV-2 in a 2-family cluster, Xuzhou, China. *Emerg Infect Dis*. 2020;26(7):1626-1628. [CrossRef]
14. Dattner I, Goldberg Y, Katriel G, et al. The role of children in the spread of COVID-19: using household data from Bnei Brak, Israel, to estimate the relative susceptibility and infectivity of children. *PLOS Comput Biol*. 2021;17(2):e1008559. [CrossRef]
15. Bicer BK, Ilhan MN. COVID-19 and health effects on children. *Gazi University Health Sciences Institute* [journal]. 2020 [special issue:103-111].
16. Mantovani A, Rinaldi E, Zusi C, Beatrice G, Saccomani MD, Dalbeni A. Coronavirus disease 2019 (COVID-19) in children and/or adolescents: a meta-analysis. *Pediatr Res*. 2021;89(4):733-737. [CrossRef]
17. Lee PI, Hu YL, Chen PY, Huang YC, Hsueh PR. Are children less susceptible to COVID-19? *J Microbiol Immunol Infect*. 2020;53(3):371-372. [CrossRef]
18. Zhang R, Wang X, Ni L, et al. COVID-19: melatonin as a potential adjuvant treatment. *Life Sci*. 2020;250:117583. [CrossRef]
19. Alschuler L, Weil A, Horwitz R, et al. Integrative considerations during the COVID-19 pandemic. *Explore (NY)*. 2020;16(6):354-356. [CrossRef]
20. Riad A, Kassem I, Issa J, Badrah M, Klugar M. Angular cheilitis of COVID-19 patients: A case-series and literature review. *Oral Dis*. 2022;28(suppl 1):999-1000. [CrossRef]
21. Xu S, Chen M, Weng J. COVID-19 and Kawasaki disease in children. *Pharmacol Res*. 2020;159:104951. [CrossRef]
22. Viner RM, Whittaker E. Kawasaki-like disease: emerging complication during the COVID-19 pandemic. *Lancet*. 2020;395(10239):1741-1743. [CrossRef]
23. Loomba RS, Villarreal E, Flores S. COVID-19 and Kawasaki syndrome: should we really be surprised? *Cardiol Young*. 2020;30(7):1059-1060. [CrossRef]
24. Centers for Disease Control and Prevention. *MIS-C info for parents* [internet]. CDC, 2020. Available at: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/children/mis-c.html
25. Halepas S, Lee KC, Myers A, Yoon RK, Chung W, Peters SM. Oral manifestations of COVID-19 related multi-system inflammatory syndrome in children: a review of 47 pediatric patients. *J Am Dent Assoc*. 2021;152(3):202-208. [CrossRef]
26. Chen J. Pathogenicity and transmissibility of 2019-nCoV—a quick overview and comparison with other emerging viruses. *Microbes Infect*. 2020;22(2):69-71. [CrossRef]
27. Bhumireddy J, Mallineni SK, Nuvvula S. Challenges and possible solutions in dental practice during and post COVID-19. *Environ Sci Pollut Res Int*. 2021;28(2):1275-1277. [CrossRef]

28. Alkis M, Ezberci S. COVID-19 - importance for pediatric dentistry. *J Dent fac Ataturk Uni*. 2020;47(1-3):205-212.
29. Ghai S. Teledentistry during COVID-19 pandemic. *Diabetes Metab Syndr*. 2020;14(5):933-935. [CrossRef]
30. Shamszadeh S, Parhizkar A, Mardani M, Asgary S. Dental considerations after the outbreak of 2019 novel coronavirus disease: a review of literature. *Arch Clin Infect Dis*. online ahead of print;15(2):e103257. [CrossRef]
31. Vergara-Buenaventura A, Castro-Ruiz C. Use of mouthwashes against COVID-19 in dentistry. *Br J Oral Maxillofac Surg*. 2020;58(8): 924-927. [CrossRef]
32. Tatar G, Salmanli M, Dogru Y, Tuzuner T. Evaluation of the effects of chlorhexidine and several flavonoids as antiviral purposes on SARS-CoV-2 main protease: molecular docking, molecular dynamics simulation studies. *J Biomol Struct Dyn*. 2021;22:1-10.
33. Ballikaya E, Esenturk G, Unverdi GE, Cehreli ZC. The new corona virus pandemic and its implications in dental practice. *Hacettepe University Faculty of Health Sciences* [journal]. 2020;7(2):92-107.
34. Keles Yucel ZP, Gurkan A. Periodontal clinical approaches in COVID-19 pandemic and normalization process. In: Emingil G, ed. *Dental Diseases and COVID-19*. 1st ed. Ankara: Turkiye Klinikleri; 2020:46-55.
35. Gomes RL, Pedrosa MS, Silva CHVd. Restorative dental treatment in times of COVID-19. *RGO Rev Gaúch Odontol*. 2020;68:e20200019. [CrossRef]
36. Amante LFLS, Afonso JTM, Skrupskelyte G. Dentistry and the COVID-19 outbreak. *Int Dent J*. 2021;71(5):358-368. [CrossRef]
37. Tatlı U. COVID-19 and dentistry practice. *Arch Med Rev J*. 2020;29:87-93.
38. Ge ZY, Yang LM, Xia JJ, Fu XH, Zhang YZ. Possible aerosol transmission of COVID-19 and special precautions in dentistry. *J Zhejiang Univ Sci B*. 2020;21(5):361-368. [CrossRef]
39. Soysal F, Isler SC, Peker I, Akca G, Ozmeric N, Unsal B. The impact of COVID-19 pandemic on dentistry practices [journal]. *Klimik Dergisi*. 2020;33(1):5-14. [CrossRef]
40. Cristiano L. Could ozone be an effective disinfection measure against the novel coronavirus (SARS-CoV-2)? *J Prev Med Hyg*. 2020;61(3): E301-E303. [CrossRef]
41. Samaranayake LP, Peiris M. Severe acute respiratory syndrome and dentistry: a retrospective view. *J Am Dent Assoc*. 2004;135(9):1292-1302. [CrossRef]
42. Peskersoy C, Ercan Devrimci E, Turkun M. Restorative dentistry applications during and after COVID-19 pandemic. In: Emingil G, ed. *Dental Diseases and COVID-19*. 1st ed. Ankara: Turkiye Klinikleri; 2020:67-74.
43. Ganesh M, Parıkh D. Chemomechanical caries removal (CMCR) agents: review and clinical application in primary teeth. *J Dent Oral Hyg*. 2011;3(3):34-45.
44. Yip HK, Stevenson AG, Beeley JA. An improved reagent for chemomechanical caries removal in permanent and deciduous teeth: an in vitro study. *J Dent*. 1995;23(4):197-204. [CrossRef]
45. Al Mortadi N, Al-Khatib A, Alzoubi KH, Khabour OF. Disinfection of dental impressions: knowledge and practice among dental technicians. *Clin Cosmet Investig Dent*. 2019;11:103-108. [CrossRef]
46. Mangano F, Gandolfi A, Luongo G, Logozzo S. Intraoral scanners in dentistry: a review of the current literature. *BMC Oral Health*. 2017;17(1):149. [CrossRef]
47. Asnani P, Asnani M, Patel N, Khan MM, Kauser A, Soni A. Coronavirus disease-19 and dentistry. *Int J Prev Clin Dent Res*. 2020;7(2):33-35. [CrossRef]
48. Dave M, Coulthard P, Patel N, Seoudi N, Horner K. Letter to the editor: use of dental radiography in the COVID-19 pandemic. *J Dent Res*. 2020;99(9):1112. [CrossRef]
49. Suri S, Vandersluis YR, Kochhar AS, Bhasin R, Abdallah MN. Clinical orthodontic management during the COVID-19 pandemic. *Angle Orthod*. 2020;90(4):473-484. [CrossRef]
50. Ozses Ergican G, Soysal H, Yetkiner E. Orthodontic applications in and after the COVID-19 Process. In: Emingil G, eds. *Dental Diseases and COVID-19*. 1st ed. Ankara: Turkiye Klinikleri; 2020:33-38.
51. Souza RCC, Costa PS, Costa LR. Dental sedation precautions and recommendations during the COVID-19 Pandemic. *Rev Bras Odontol*. 2020;77:e1788.
52. Namineni S, Mallineni SK. Practice of nitrous oxide inhalation sedation in dentistry during and after the COVID-19 pandemic. *J Dent Anesth Pain Med*. 2020;20(4):261-262. [CrossRef]
53. Ilyas N, Agel M, Mitchell J, Sood S. COVID-19 pandemic: the first wave - an audit and guidance for paediatric dentistry. *Br Dent J*. 2020;228(12):927-931. [CrossRef]
54. T.C Ministry of Health. *Working Guide in Health Institutions and Infection Control Precautions* [internet]. TCSB. 2020. Available at: https://covid19.saglik.gov.tr/Eklenti/40282/0/covid19-saglikkurumlarindacalismarehberiveenfeksiyonkontrolonlemleripdf.pdf
55. Al-Nerabiah Z, Alkhouli M, Laflouf M, Abdul-Hak M. Pediatric dentists consideration for COVID-19 in children. *Int J Appl Dent Sci*. 2020;6(2):628-630.
56. Sales SC, Meyfarth S, Scarparo A. The clinical practice of Pediatric Dentistry post- COVID-19: the current evidences. *Pediatr Dent J*. 2021;31(1):25-32. [CrossRef]
57. Salma U, Tiwari RVC, Managutti A, Azad M, Ravuri P. Kommuri S ve ark. The challenging perception of pediatric dental practice post COVID the new normal. *J Oral Dent Res*. 2020;5(9):434-437.
58. Luzzi V, Ierardo G, Bossù M, Polimeni A. Paediatric Oral Health during and after the COVID-19 pandemic. *Int J Paediatr Dent*. 2021;31(1):20-26. [CrossRef]
59. Kumar S, Tadakamadla J, Kroon J, Johnson NW. Impact of parent-related factors on dental caries in the permanent dentition of 6-12-year-old children: a systematic review. *J Dent*. 2016;46:1-11. [CrossRef]
60. Ezberci S, Tuloglu N, Aykut Yetkiner A. Pediatric dentistry algoritm after COVID-19 pandemic. In: Emingil G, ed. *Dental Diseases and COVID-19*. 1st ed. Ankara: Turkiye Klinikleri; 2020:39-45.
61. Paglia L. COVID-19 and Paediatric Dentistry after the lockdown. *Eur J Paediatr Dent*. 2020;21(2):89. [CrossRef]
62. BaniHani A, Gardener C, Raggio DP, Santamaría RM, Albadri S. Could COVID-19 change the way we manage caries in primary teeth? Current implications on Paediatric Dentistry. *Int J Paediatr Dent*. 2020;30(5):523-525. [CrossRef]
63. Al-Halabi M, Salami A, Alnuaimi E, Kowash M, Hussein I. Assessment of paediatric dental guidelines and caries management alternatives in the post COVID-19 period. A critical review and clinical recommendations. *Eur Arch Paediatr Dent*. 2020;21(5):543-556. [CrossRef]
64. Gurcan AT. Current caries removal approaches. *Turk Klin J Pediatr Dent*. 2018;4(1):63-67.
65. Haciogullari I, Ulusoy N, Cengiz E. Alternative New Methods for the Treatment of Deep Dentine Caries. *J Dent Fac Ataturk Uni*. 2016:120-136.
66. Innes NP, Evans DJ, Bonifacio CC, et al. The Hall Technique 10 years on: questions and answers. *Br Dent J*. 2017;222(6):478-483. [CrossRef]
67. Frencken JE, Pilot T, Songpaisan Y, Phantumvanit P. Atraumatic restorative treatment (ART): rationale, technique, and development. *J Public Health Dent*. 1996;56(3):135-140; discussion 161-163. [CrossRef]
68. Saber AM, El-Housseiny AA, Alamoudi NM. Atraumatic restorative treatment and interim therapeutic restoration: a review of the literature. *Dent J (Basel)*. 2019;7(1):28. [CrossRef]
69. Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. *Oral Health Prev Dent*. 2008;6(4):315-321.
70. Gotjamanos T. Pulp response in primary teeth with deep residual caries treated with silver fluoride and glass ionomer cement ('atraumatic' technique). *Aust Dent J*. 1996;41(5):328-334. [CrossRef]
71. Horuztepe SA, Ergin E, Gurcan S. A new method for the treatment of white spot lesions, resin infiltration technique: case report. *Acta Odontol Turc*. 2015;32(3):153-157.